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(54) METHOD FOR THE MANUFACTURE OF HIGHLY ELASTIC FIBER PRODUCT

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# **BRIEF EXPLANATION OF THE FIGURES**

Figure 1 is an enlarged diagonal diagram of fiber strand A. Figure 2 is an enlarged diagonal diagram of an example of fiber strand B. Figure 3 is an enlarged frontal [sic; diagonal] diagram of an example of fiber strand C. Figure 4 is an enlarged frontal diagram of an example with the fiber strand A in the warp direction and the fiber strand B in the filling [weft] direction. Figure 5 is an enlarged front diagram of an example with the fiber strand A, B, and C in the warp and filling directions.

## DETAILED EXPLANATION OF THE INVENTION

The present invention concerns a method for the manufacture of fiber products with a high elasticity and beautiful finish by a simple operation. Conventionally, there have been highly elastic fiber products formed partially using fiber strands with an elongation of 5 to 10 times the original length, such as highly elastic synthetic fiber strands, e.g., recently produced polyurethane synthetic fiber strands.

However, in all the conventional manufacturing processes, control of the highly elastic synthetic fiber strands that are extended by a small tension is difficult, and the manufacturing device becomes large, yet the product finish is not satisfactory.

The present invention succeeds in overcoming such problems by an extremely simple process. Namely, in the present invention use is made of a specialty fiber strand (hereafter referred to as fiber strand A) containing a water-soluble elastic [sic] polyvinyl-alcohol-based synthetic fiber strand core wound with a continuous fiber strand and, if needed, sized with a water-soluble size; a specialty fiber strand (hereafter referred to as fiber strand B) containing a highly elastic synthetic fiber strand partially combined with a high-strength polyvinyl-alcohol-based synthetic fiber strand and, if needed, sized with a water-soluble size with temporary arrest of the elongation; or a specialty fiber strand (hereafter referred to as fiber strand C) containing the fiber strand B wound with various continuous fiber strands. Fiber products woven with such fiber strands in the warp or filling direction, or in both the warp and filling directions, are finally treated with water to strip only the polyvinyl-alcohol-based fiber strand for display of a high elasticity to obtain highly elastic fiber products.

According to the manufacturing process of the present invention, stretching of the highly elastic synthetic fiber strand is temporarily suppressed by the partially included polyvinyl-alcohol-based synthetic fiber strand, thus the weaving operation is very easy and control of the constitutional conditions for the fiber strand A with the fiber strand B or C is extremely easy in obtaining highly elastic fiber products with a beautiful finish.

First, the key factors of the present invention, i.e., constitutions of the fiber strand A, fiber strand B, and fiber strand C are explained. The fiber strand A contains a water-soluble high strength polyvinyl-alcohol-based synthetic fiber strand (1) as the core, which is wound with various continuous fiber strands (2), then sized with a water-soluble size if needed.

Therefore, the weaving operation is easy, and upon dissolution of the polyvinyl-alcohol-based synthetic fiber strand core by water, the loose continuous fiber strand (2) wound on the core can be straightened, thus control of the winding can control the stretchability of the fiber product. The fiber strand B contains highly elastic synthetic fiber strand (3) partially combined with water-soluble high strength polyvinyl-alcohol-based synthetic fiber strand (4), and is sized with a water-soluble size if needed, thus the stretching is temporarily arrested. Therefore, there

will be no elongation of the highly elastic synthetic fiber strand (3) during weaving, and conventional weaving machines can be used with a very high efficiency.

The above combining can be made by lightly winding the water-soluble polyvinyl-alcohol-based synthetic fiber strand (4) on the highly elastic synthetic fiber strand (3), combining the two strands, and twisting said strands together as shown in Figure 2.

The fiber strand C consists of the fiber strand B, i.e., the highly elastic synthetic fiber strand (5) partially combined with the polyvinyl-alcohol-based synthetic fiber strand (6), as the core, which is then wound with various continuous fiber strands (7) and sized with a water-soluble size, if needed, for temporary arresting of the stretching of the entire fiber, resulting in easy weavability. The continuous fiber strand (7) used for winding protects and reinforces the highly elastic synthetic fiber strand in the core and also controls the stretchability of the highly elastic synthetic fiber strand.

Next, the fiber products of the present invention obtained using such fiber strands are explained. In the case of products displaying high elasticity in the warp or filling directions, the fiber strand B or C may be placed in parallel with the fiber strand A.

For example, as shown in Figure 4, when woven with 3 A strands in the warp direction and 1 B strand placed at a certain gap with various fiber strands (8) in the filling direction, a product with a high potential stretchability in the warp direction is obtained.

For products with high stretchability in both the warp and filling directions, weaving may be done with combinations of the fiber strand B or C with the fiber strand A in both the warp and filling directions. Figure 5 shows one such example in the warp direction (4 A strands and 1 B strand) and filling direction (3 A strands and 1 C strand) in weaving.

The overall stretchability of fiber products of the present invention is mainly determined by the performance of the highly elastic synthetic fiber strands, the constitution of strands A, B, and C, combination conditions of the strands A, B, and C, and arrangement conditions of the constitutional strands in the warp and filling directions.

In the present invention, the fiber products thus obtained are finally treated with water to dissolve out only the polyvinyl-alcohol-based synthetic fiber strand in the fiber products, resulting in a sufficient display of each fiber strand A, B, and C, thus a high stretchability is imparted to the overall fiber products.

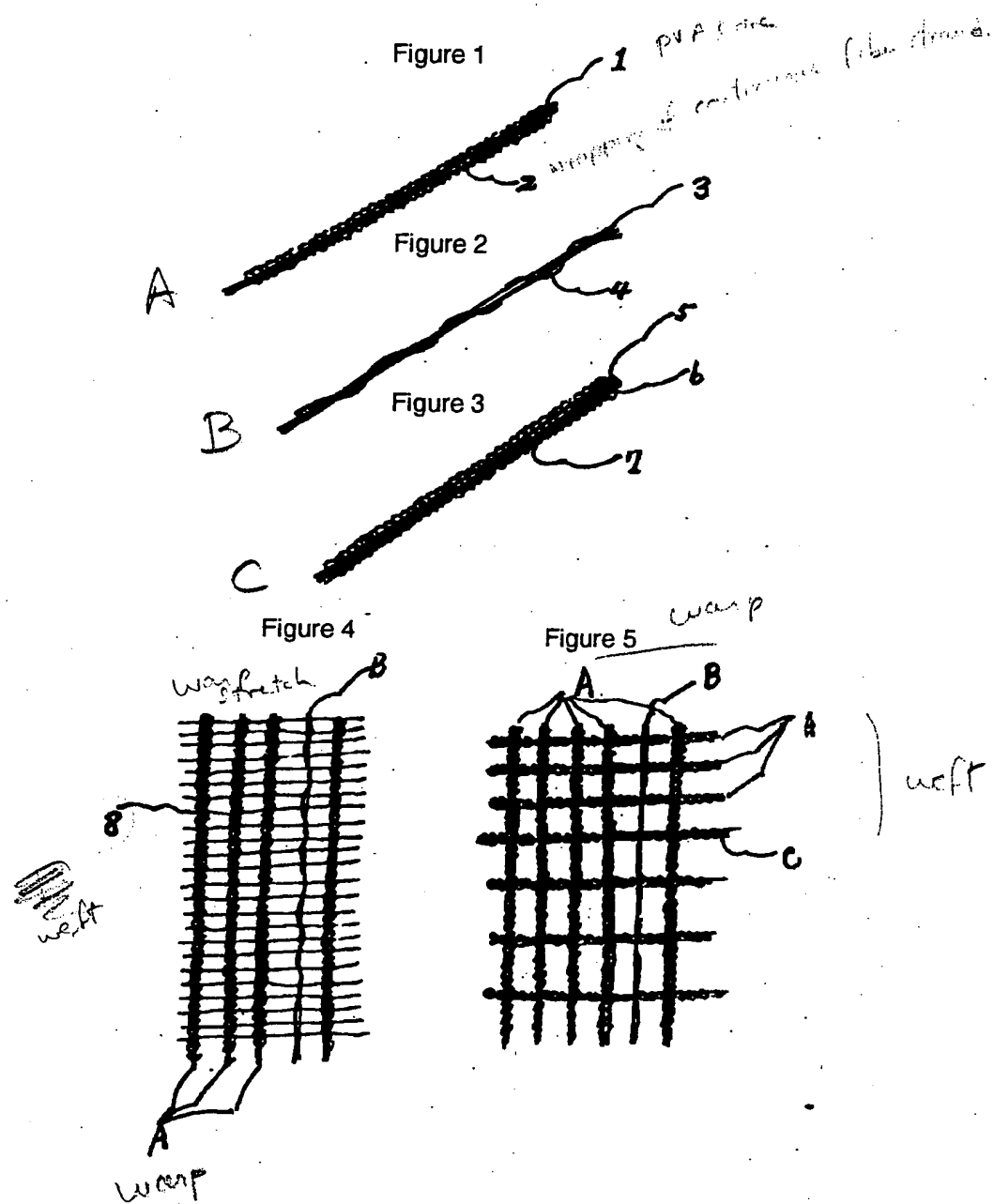
The temperature of water used for the dissolution is closely related to the manufacturing conditions for the polyvinyl-alcohol-based synthetic fiber strands, and a temperature ranging from a low temperature to that of boiling water can be used.

With pre-coloring of the polyvinyl-alcohol-based synthetic fiber strand, its relationship with other fiber strands in making fiber strands A, B, and C can be clearly recognized, facilitating the process, and the degree of dissolution by water can be readily confirmed.

As explained above, according to the present invention, the fiber products are prepared with a certain combination of fiber strand A having a loose continuous fiber strand, stretching fiber strand B made from a highly elastic synthetic fiber partially combined with a water-soluble polyvinyl-alcohol-based synthetic fiber strand, fiber strands C and B, or fiber strand C, thus the fiber products can be manufactured efficiently without any special apparatuses, having a very beautiful finish and an easily realized stretchability. This process is believed to make a great contribution to the industry.

## CLAIM

A method for the manufacture of a highly elastic fiber product by combining a specialty fiber strand containing a water-soluble high strength polyvinyl-alcohol-based synthetic fiber strand core wound with a continuous fiber strand and, if needed, sized with a water-soluble size, with a specialty fiber strand containing a highly elastic synthetic fiber strand partially combined with a high strength polyvinyl-alcohol-based synthetic fiber strand and, if needed, sized with a water-soluble size, with temporary arrest of elongation, or with a specialty fiber strand containing the immediately above fiber strand wound with various continuous fiber strands and weaving them with such fiber strands in the warp or filling direction or in both the warp and filling directions, and finally treating the woven product with water to strip only the polyvinyl-alcohol-based fiber strand for the display of a high elasticity.



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